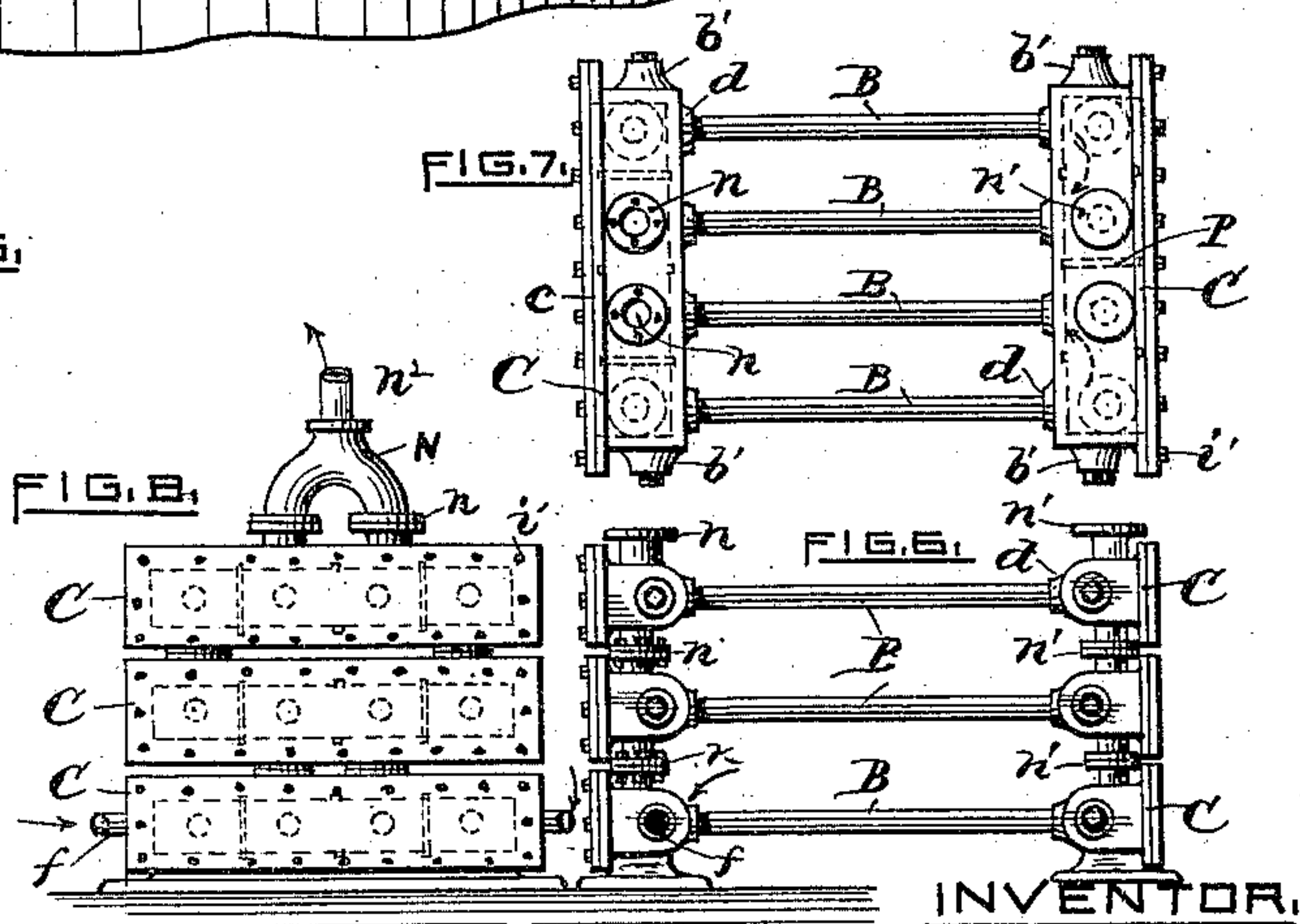
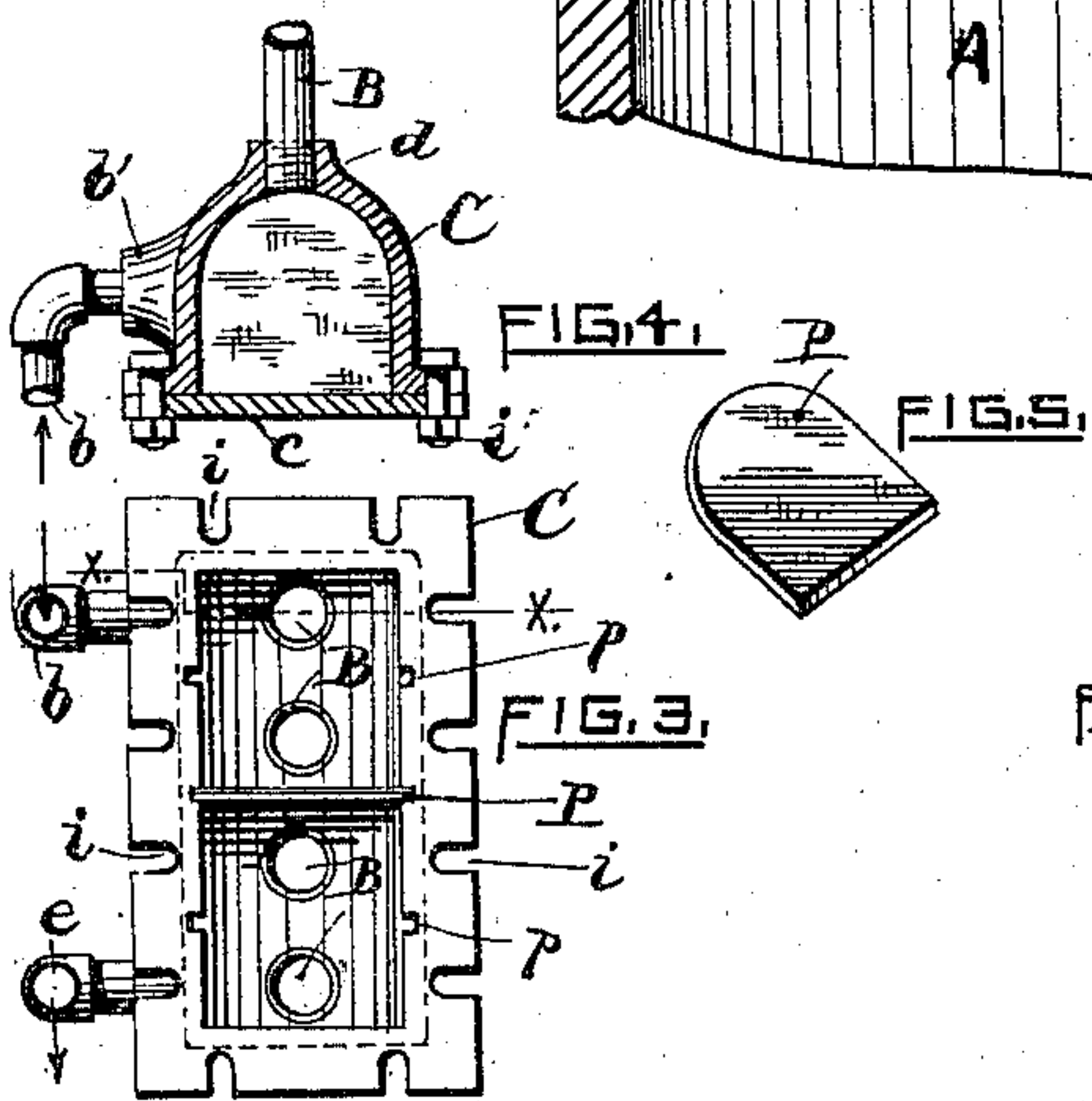
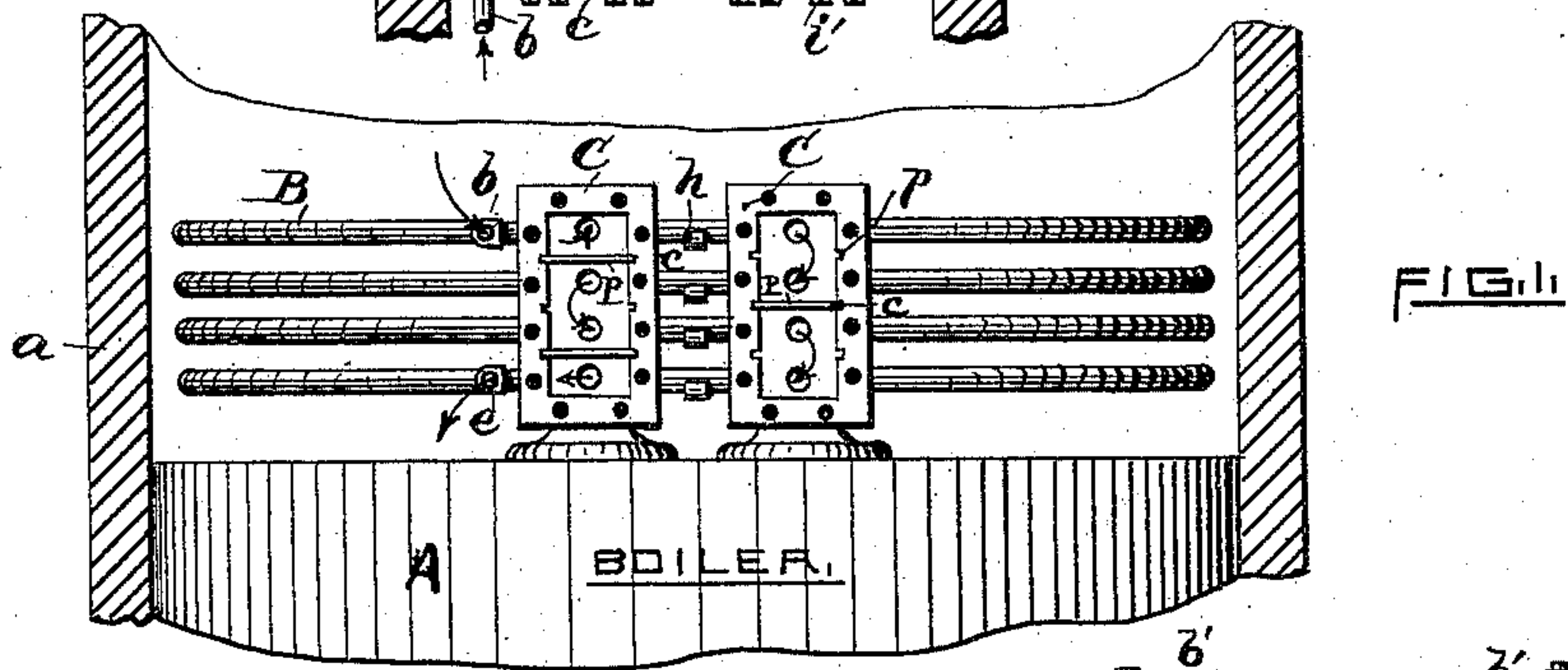
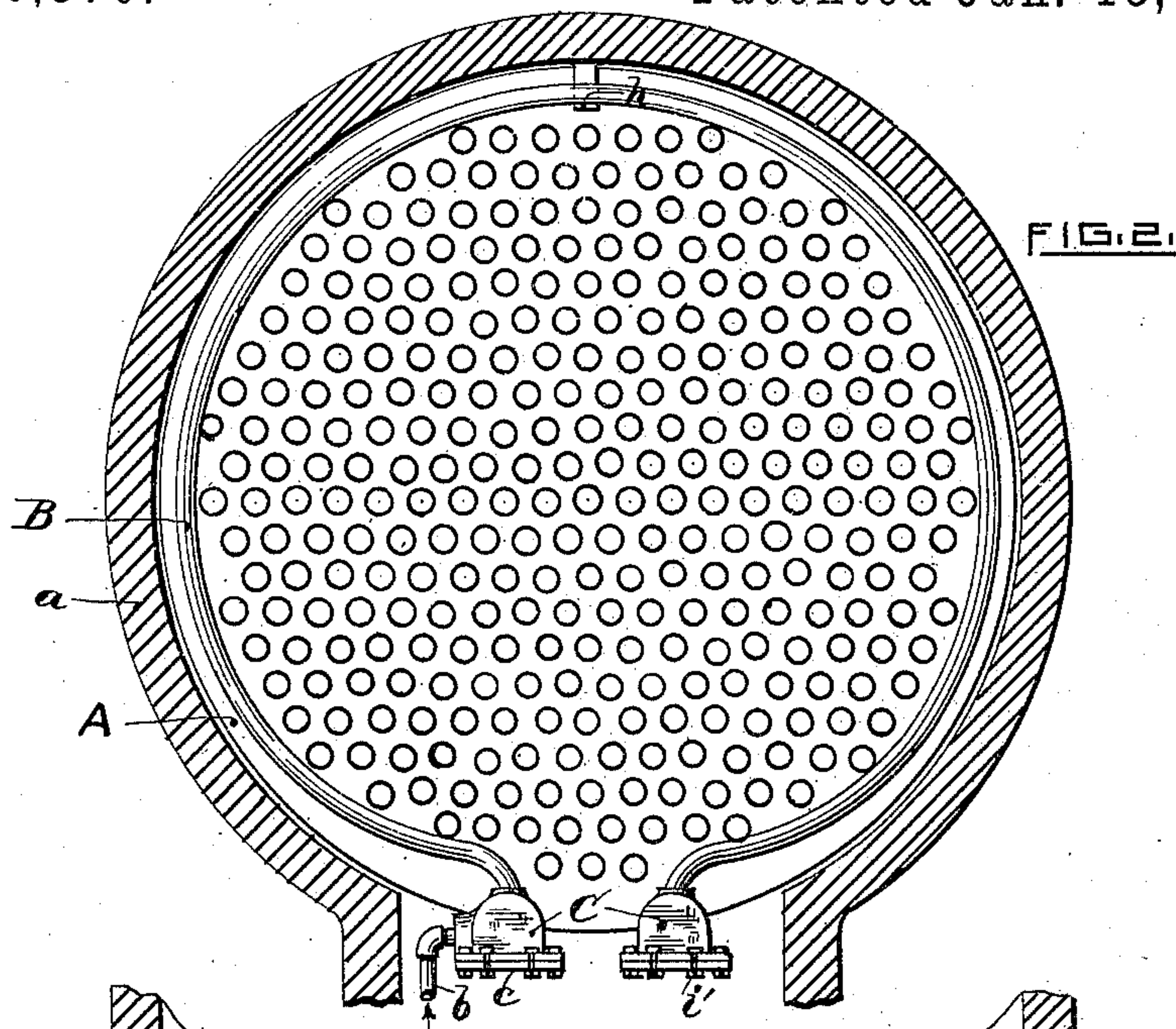


(No Model.)

T. EVANS.
FEED WATER HEATER.

No. 310,570.

Patented Jan. 13, 1885.



WITNESSES,

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UNITED STATES PATENT OFFICE.

THOMAS EVANS, OF PROVIDENCE, RHODE ISLAND.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 310,570, dated January 13, 1885.

Application filed August 12, 1884. (No model.)

To all whom it may concern:

Be it known that I, THOMAS EVANS, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Feed-Water Heaters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to feed-water heaters of the class adapted to utilize the waste gases from the boiler-furnace.

The invention consists, essentially, of a head or casting, into which the circulating-water tubes are secured, in combination with one or more removable plates or partitions so arranged that the direction of the feed-water may be readily altered when desired.

The invention further consists in combining a series of these heads and tubes together by means of nozzles, &c., whereby the heating capacity is increased.

The invention also admits of the free expansion and contraction of the tubes by means of alternate open and blank nozzles, all as will be more fully hereinafter set forth.

In the accompanying sheet of drawings, Figure 1 represents a front elevation of the heater, the bonnets or covers being removed, the heater in this case being placed over an upright tubular boiler. Fig. 2 is a plan view of the same. Fig. 3 is an enlarged front view of one of the heads, showing a removable partition or plate—the cover not shown. Fig. 4 is a horizontal sectional view through *xx* of Fig. 3. Fig. 5 is a perspective view of the partition or plate. Fig. 6 is a side elevation of a modification of the invention, showing straight tubes, the sections being united at one end by flanged nozzles. Fig. 7 is a plan view of the same, and Fig. 8 is an end elevation.

The object of this invention is to provide a simple, cheap, and at the same time efficient means for heating feed-water before it enters the boiler, the heater in question being interposed between the pump and boiler, all the

parts of the heater being readily accessible for the purpose of inspection or repairs.

The invention also admits of heaters thus constructed being conveniently built up or enlarged, when desired, for the purpose of heating a greater volume of water; and, further, by means of the removable partitions, the water is adapted to be admitted into any desired part of the heads, from whence it courses in a zigzag direction to the outlet-pipe, and thence into the boiler.

The following is a description of the invention and the manner of its operation:

Again referring to the drawings, C, Figs. 3 and 4, designates an elongated head or shell, provided with hubs or bosses *d*, into which circulating-water tubes B are secured in any well-known manner. Side or end bosses, *b'*, are adapted to receive the inlet and outlet pipes *b* *e*. A bonnet or cover, *c*, is secured to a corresponding flange of the head by means of bolts *i'*. One or more grooves, *p*, are formed within the head between each tube B, as shown, these grooves being adapted to receive the plates or partitions P.

Figs. 1 and 2 represent the heater applied to a vertical tubular boiler, A, the heated escaping gases from the boiler to the flue serving to increase the temperature of the water circulating within the tubes B. The heads C being placed on end, as shown, side by side, and being connected together by the tubes, having a nearly circular form, the cold water is represented as entering the top of the head by means of the pipe *b*, thence around the top tube B into the other head, then back around the second tube into the first head; thence by means of the partition P the water flows back through the third tube and again into the second head, from whence it enters the lower tube and into the lower chamber of the first head, and thence into the boiler by means of the pipe *e*. The arrows indicate the course of the water in its passage through the heater. The lower tube B being in contact with the hottest gases causes the water to issue therefrom into the boiler at a very high temperature. The curved form of the tubes admits of free expansion and contraction. Hooks *h* serve to retain the tubes in position.

Figs. 6, 7, and 8 represent a modification of

the heater, showing the heads arranged horizontally over each other, the water in this case entering at each end of the bottom head, C, by means of pipes *f*, from whence it flows
 5 through the tubes B into the rear head, thence back through the two middle tubes and into the center chamber of the front head, up through
 10 nozzles *n n*, into the next or middle course, thence again back and forth until the heated water finally leaves the heater by means of
 15 the top pipe, *n*², into the boiler. The rear nozzles, *n'*, are blank and unbolted, thus permitting of expansion and contraction of the tubes without injury to the heater.

15 It is obvious that the capacity of the heater may be increased by additional sections. The water may be admitted into any portion of the head, and directed as desired by means of the said removable partitions P. By removing
 20 all the partitions a simple tubular heater is produced, but at the same time one having a limited amount of water circulation.

Another advantage of the invention is that a ruptured tube may be easily removed from
 25 the head and the hole plugged with wood—the internal pressure retaining it in place—without seriously affecting the efficiency of the heater. A new tube may be readily replaced, as the whole interior of the head is accessible
 30 by removing the cover. A simple steam-jet or brush serves to clean the exterior of the tubes, as common.

It is also apparent that heaters thus constructed can be placed in a vertical, horizon-

tal, or inclined position, corresponding to the
 35 selection of its location with reference to the boiler-flue, &c.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination, in a feed-water or other analogous heater composed of heads having tubes secured thereto, means for admitting water into the heater, and suitable outlets therefor, of one or more plates or partitions
 45 adapted to be removably secured within each head, substantially as shown, and for the purposes set forth.

2. The feed-water heater for upright boilers herein described, consisting of heads C, tubes
 50 B, connecting the heads, means for admitting and exhausting the heated water, and means, substantially as shown, for dividing the heads into chambers, substantially as shown, and for the purpose set forth.

3. In a feed-water heater, the head C herein described, having suitable bosses and nozzles, and further provided with internal grooves,
 55 *p*, between the tubes, said grooves adapted to receive plates P, the whole combined and arranged substantially as shown and set forth.

In testimony whereof I have affixed my signature in presence of two witnesses.

THOMAS EVANS.

Witnesses:

GEO. H. REMINGTON,
 CHARLES HANNIGAN.